

WHAT IS CLAIMED IS:

1                   1.       In a digital information processing system wherein a model of a finite  
2 state machine (FSM) receives a plurality of FSM inputs and produces a plurality of FSM  
3 outputs, a method for updating soft decision information on said FSM input symbols into  
4 higher confidence information, the method comprising:

- 5                   (a) inputting said soft decision information in a first index set;  
6                   (b) combining said input soft decision information with knowledge regarding  
7 said finite state machine;  
8                   (c) outputting said higher confidence information;  
9                   (d) modifying said input soft decision information using said output higher  
10 confidence information via a feedback path; and  
11                   (e) repeating steps (a) to (d) until a termination condition is met.

1                   2.       In a digital information processing system wherein a model of a finite  
2 state machine (FSM) receiving a plurality of FSM inputs and producing a plurality of FSM  
3 outputs is represented by a reduced-state trellis and wherein said FSM inputs are defined on a  
4 base closed set of symbols, a method for updating soft decision information on said FSM  
5 inputs into higher confidence information, the method comprising:

- 6                   (a) inputting said soft decision information in a first index set;  
7                   (b) processing a forward recursion on said input soft decision information  
8 based on said reduced-state trellis representation to produce forward state metrics;  
9                   (c) processing a backward recursion on said input soft decision information  
10 based on said reduced-state trellis representation to produce backward state metrics, wherein  
11 said backward recursion is independent of said forward recursion;  
12                   (d) operating on said forward state metrics and said backward state metrics to  
13 produce said higher confidence information; and  
14                   (e) outputting said higher confidence information.

1                   3.       The method of claim 2, further comprising the steps of:

- 2                   (f) modifying said input soft decision information using said output higher  
3 confidence information via a feedback path; and  
4                   (g) repeating steps (a) to (f) until a termination condition is met.

1                   4.       The method of claim 2, wherein said operating comprises at least one  
2 of the following operations: summing, multiplication, minimum, maximum, minimum\*,  
3 maximum\*, linear weighting and exponentiation.

1                   5.       The method of claim 2, wherein the step of forward recursion  
2 processing includes the steps of:  
3                   using residual state information to augment reduced-state trellis information to  
4 produce said forward state metrics; and  
5                   updating said residual state information.

1                   6.       The method of claim 2, wherein the step of backward recursion  
2 processing includes the steps of:  
3                   using residual state information to augment reduced-state trellis information to  
4 produce said backward state metrics; and  
5                   updating said residual state information.

1                   7.       The method of claim 5, wherein said residual state information is a  
2 plurality of decisions on said FSM inputs.

1                   8.       The method of claim 6, wherein said residual state information is a  
2 plurality of decisions on said FSM inputs.

1                   9.       The method of claim 7, wherein said decisions on said FSM inputs are  
2 defined on a revised closed set of symbols, wherein said revised closed set of symbols is a  
3 partitioning of said base closed set of symbols.

1                   10.      The method of claim 8, wherein said decisions on said FSM inputs are  
2 defined on a revised closed set of symbols, wherein said revised closed set of symbols is a  
3 partitioning of said base closed set of symbols.

1                   11.      The method of claim 2, wherein the digital information processing  
2 system is operative to perform at least one of the following functions:  
3                   iterative detection;  
4                   iterative decoding;  
5                   turbo detection;  
6                   turbo decoding;

7 message passing; and  
8 belief propagation.

1 12. The method of claim 2, wherein said finite state machine is operative  
2 to model at least one of the following:

3 a communication medium;  
4 a storage medium; and  
5 an imaging medium.

1 13. The method of claim 2, wherein said finite state machine is operative  
2 to model at least one of the following:

3 allowable input and output pairs of a forward error correction code; and  
4 a forward error correction encoder.

1 14. The method of claim 2, wherein said finite state machine is operable to  
2 model a composite signal comprising at least one desired signal and at least one interference  
3 signal.

1 15. In a digital information processing system wherein a model of a finite  
2 state machine (FSM) receiving a plurality of FSM inputs and producing a plurality of FSM  
3 outputs is represented by a reduced-state trellis and wherein said FSM inputs are defined on a  
4 base closed set of symbols, a method for updating soft decision information on said FSM  
5 inputs into higher confidence information, the method comprising:

6 (a) inputting said soft decision information in a first index set;

7 (b) processing a forward recursion on said input soft decision information  
8 based on said reduced-state trellis representation to produce forward state metrics and  
9 forward transition metrics;

10 (c) processing a backward recursion on said input soft decision information  
11 based on said reduced-state trellis representation to produce backward state metrics and  
12 backward transition metrics, wherein said backward recursion is independent of said forward  
13 recursion;

14 (d) operating on said forward state metrics, said forward state transition  
15 metrics, said backward state metrics and said backward state transition metrics to produce  
16 said higher confidence information; and

17 (e) outputting said higher confidence information.

1           16.    The method of claim 15, further comprising the steps of:  
2           (f) modifying said input soft decision information using said output higher  
3 confidence information via a feedback path; and  
4           (g) repeating steps (a) to (f) until a termination condition is met.

1           17.    The method of claim 15, wherein said operating comprises at least one  
2 of the following operations: summing, multiplication, minimum, maximum, minimum\*,  
3 maximum\*, linear weighting and exponentiation.

1           18.    The method of claim 15, wherein the step of forward recursion  
2 processing includes the steps of:  
3           using residual state information to augment reduced-state trellis information to  
4 produce said forward state metrics; and  
5           updating said residual state information.

1           19.    The method of claim 15, wherein the step of backward recursion  
2 processing includes the steps of:  
3           using residual state information to augment reduced-state trellis information to  
4 produce said backward state metrics; and  
5           updating said residual state information.

1           20.    The method of claim 18, wherein said residual state information is a  
2 plurality of decisions on said FSM inputs.

1           21.    The method of claim 19, wherein said residual state information is a  
2 plurality of decisions on said FSM inputs.

1           22.    The method of claim 20, wherein said decisions on said FSM inputs  
2 are defined on a revised closed set of symbols, wherein said revised closed set of symbols is a  
3 partitioning of said base closed set of symbols.

1           23.    The method of claim 21, wherein said decisions on said FSM inputs  
2 are defined on a revised closed set of symbols, wherein said revised closed set of symbols is a  
3 partitioning of said base closed set of symbols.

1           24.     The method of claim 15, wherein the digital information processing  
2 system is operative to perform at least one of the following functions:

3           iterative detection;  
4           iterative decoding;  
5           turbo detection;  
6           turbo decoding;  
7           message passing; and  
8           belief propagation.

1           25.     The method of claim 15, wherein said finite state machine is operative  
2 to model at least one of the following:

3           a communication medium;  
4           a storage medium; and  
5           an imaging medium.

1           26.     The method of claim 15, wherein said finite state machine is operative  
2 to model at least one of the following:

3           allowable input and output pairs of a forward error correction code; and  
4           a forward error correction encoder.

1           27.     The method of claim 15, wherein said finite state machine is operable  
2 to model a composite signal comprising at least one desired signal and at least one  
3 interference signal.

1           28.     The method of claim 15, wherein the digital information processing  
2 system is a system performing iterative detection, iterative decoding, turbo detection, turbo  
3 decoding, message passing, or belief propagation.

1           29.     A digital information processing system for updating soft decision  
2 information into higher confidence information by representing a model of a finite state  
3 machine (FSM) receiving a plurality of FSM inputs and producing a plurality of FSM outputs  
4 as a reduced-state trellis, wherein said FSM inputs are defined on a base closed set of  
5 symbols, the system comprising:

6           means for inputting said soft decision information in a first index set;

7 means for processing a forward recursion on said input soft decision  
8 information based on said reduced-state trellis representation to produce forward state  
9 metrics;  
10 means for processing a backward recursion on said input soft decision  
11 information based on said reduced-state trellis representation to produce backward state  
12 metrics, wherein said backward recursion is independent of said forward recursion;  
13 means for operating on said forward state metrics and said backward state  
14 metrics to produce said higher confidence information; and  
15 means for outputting said higher confidence information.

1 30. A digital information processing system for updating soft decision  
2 information into higher confidence information by representing a model of a finite state  
3 machine (FSM) receiving a plurality of FSM inputs and producing a plurality of FSM outputs  
4 as a reduced-state trellis, wherein said FSM inputs are defined on a base closed set of  
5 symbols, the system comprising:

6 means for inputting said soft decision information in a first index set;  
7 means for processing a forward recursion on said input soft decision  
8 information based on said reduced-state trellis representation to produce forward state metrics  
9 and forward state transition metrics;  
10 means for processing a backward recursion on said input soft decision  
11 information based on said reduced-state trellis representation to produce backward state  
12 metrics and backward state transition metrics, wherein said backward recursion is  
13 independent of said forward recursion;  
14 means for operating on said forward state metrics, said forward state transition  
15 metrics, said backward state metrics and said backward state transition metrics to produce  
16 said higher confidence information; and  
17 means for outputting said higher confidence information.

1 31. A digital information processing device for updating soft decision  
2 information into higher confidence information by representing a model of a finite state  
3 machine (FSM) receiving a plurality of FSM inputs and producing a plurality of FSM outputs  
4 as a reduced-state trellis, wherein said FSM inputs are defined on a base closed set of  
5 symbols, the device comprising:

6 a plurality of device inputs for inputting said soft decision information in a  
7 first index set;  
8 a plurality of processing units for processing a forward recursion on said input  
9 soft decision information based on said reduced-state trellis representation to produce  
10 forward state metrics, processing a backward recursion on said input soft decision  
11 information based on said reduced-state trellis representation to produce backward state  
12 metrics, wherein said backward recursion is independent of said forward recursion, and  
13 operating on said forward state metrics and said backward state metrics to produce said  
14 higher confidence information; and  
15 a plurality of device outputs for outputting said higher confidence information.

1 32. A digital information processing device for updating soft decision  
2 information into higher confidence information by representing a model of a finite state  
3 machine (FSM) receiving a plurality of FSM inputs and producing a plurality of FSM outputs  
4 as a reduced-state trellis, wherein said FSM inputs are defined on a base closed set of  
5 symbols, the device comprising:

6 a plurality of device inputs for inputting said soft decision information in a  
7 first index set;  
8 a plurality of processing units for processing a forward recursion on said input  
9 soft decision information based on said reduced-state trellis representation to produce  
10 forward state metrics and forward state transition metrics, processing a backward recursion  
11 on said input soft decision information based on said reduced-state trellis representation to  
12 produce backward state metrics and backward state transition metrics, wherein said backward  
13 recursion is independent of said forward recursion, and operating on said forward state  
14 metrics, said forward state transition metrics, said backward state metrics and said backward  
15 state transition metrics to produce said higher confidence information; and  
16 a plurality of device outputs for outputting said higher confidence information.  
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